of successive differentiation, and produce the *soma* as an instrument for nourishing and maturing the remaining germ cells. As a matter of fact, in many animals the cells that are to become reproductive or ancestors of germ cells are early to be distinguished in the development, but we need not confine ourselves to this method, for *we get rid of the necessity of a continuity of germ cells by assuming a continuity of germinal plasm.* By germinal plasm is meant the true idioplasm which can differentiate into all the organs of the body. When once differentiated it has lost its generic character by analysis.

Weismann conceives ontogenetic development to be a series of successive simplifications of the idioplasm that is producing the soma, a successive analysis, as above noted, when speaking of ectoderm and entoderm. *But in any cell some idioplasm may remain undifferentiated*, while the remainder differentiates. There is differentiated plasma as well as undifferentiated, even in germinal cells; for the reproductive cells are tissues, and require "*oogenic*" and "*spermagenic*" plasma, just as the tissues in general require "*histogenic*" plasma. But when any cell which contains undifferentiated germ plasm is to take on itself the function of being reproductive, it must get rid of the histogenic plasm, and this is the significance of the polar globules extruded by eggs and the paranuclei found in spermatogenesis. Not till these bodies are formed will the pronuclei unite. Everywhere the process of extrusion of nuclear material is twice repeated, (the first globule itself also divides.) The first globule is supposed by Weismann to be the histogenic (*oogenic*) plasma, the second to be the equivalent of the spermatozoon. Strangely enough, Weismann later (*Ber. Natf. ges. Freiburg*, III, 1887,) discovered that parthenogenetic eggs (such can develop without fertilization) have only one polar globule. It would be interesting to know what takes place in the case of the queen bee, who fertilizes her eggs at will, the unfertilized ones hatching into males. To satisfy the theory these eggs should all extrude one globule, and then if fertilization takes place a second should be given off.

By saying that the second globule is the equivalent of the spermatozoon, Weismann does not think (like Minot and others) that there is one peculiar sort of idioplasm called "male" in the spermatozoon, and a "female" sort in the ovum, and that we can speak of "hermaphrodite cells." The cytoplasmic parts of germ cells have been differentiated to enable idioplasm essentially alike (as alike as are the male and female oyster) to reach each other and coalesce. In all cells that become reproductive, he would say some undifferentiated germ plasm was present, but in ordinary tissue cells produced by differentiated division he emphatically denies the possibility of such a thing. In this regard he opposes Kölliker.

Die Bedeutung der Zellen kerne für die Vorgänge der Vererbung. KÖLLIKER. Zeitsch. f. Wiss. Zool. Bd. 42.

This author conceives the idioplasm of all cells as similar, or in other words, all cells contain undifferentiated idioplasm; and there is no such thing as a differentiational cell division; not but that cells may start on different lines of development, but this is due, not to internal arrangements, but to external causes. It is, therefore, the action of the environment that determines the rôle of a cell. All cells are fundamentally like the germ cells. The problem is the same as that concerning latent characters; a certain environment has produced a definite result with any given sample of protoplasm; a different environment would have produced a different result. In each sex lies latent the character of the species, and the *sex* was determined during development by external causes. Of course, after differentiation has ensued it is practically impossible for involution and a new start in a different direction to

take place. This point is emphasized by Weismann as against Kölliker; but we conceive the principal point at issue between the two thinkers lies in their conception of the relation of cell division to differentiation. To Weismann ontogeny is an analysis, due to inherent mechanical arrangements in the protoplasm. To Kölliker, ontogenetic differentiation, like phylogenetic differentiation, is dependent on external conditions. Kölliker does not push his theory to logical conclusions. He might say: If one of the conjugating pronuclei could be replaced by a nucleus from a brain cell or a liver cell for example, there would be no radical dislocation in the embryonic development. This position appears scientifically defensible; and we could add a second scholium, viz.: That in this experiment any fragment of a nucleus taken without definite shape or size, would do just as well, because the nucleus appears to be an aggregate of a vast number of similar gemmules. But the most important question of heredity, viz., How are the new characters acquired by the germ plasm? is still unanswered. Weismann emphatically disbelieves that acquired characters can be transmitted, or that the germ cell receives anything except food from the body. He is forced to the conclusion, that the germ plasm must vary indefinitely, and that adaptation is due to natural selection simply. It seems to be rash to deny that the body has a definite action on the germ cells. The researches of Gaule and his pupils tend to show that something more vital than food wanders from cell to cell. In this line we have to await further developments. Gaule believes that gemmules make the circuit of the tissues to finally lodge in the reproductive organs. The following author dwells on this aspect of the problem.

Ueber Vererbung. NUSSBAUM. Bonn, 1888.

Nussbaum seems to mediate between the positions of Weismann and Kölliker. He admits that like can produce only like, but germinal matter is probably more widely spread than Weismann believes. In the protozoa, Weismann has admitted that the environment causes characters to be acquired that are transmitted, because here is asexual reproduction by division. But we have seen that the nucleus governs the formation of structures in *stentor*, etc., hence the environment must first affect the nucleus, and we naturally conclude that as the germ cell has the power to produce a soma for its own nutrition, that the same soma is an instrument of mediation between the environment and the germ cell. The fact that the character of the father of the first offspring affects the subsequent offspring of the same mother, but by a different father, (ignored by many theories of heredity) shows that sexual cells are capable of marked and definite modification. In this connection we may mention Sequard's experiments upon rabbits. By artificially produced lesions of the cord, epilepsy was caused; and the offspring of such epileptic rabbits suffered from congenital epilepsy.

Ueber die Vererbung. WEISMANN. Jena, 1883.

By Weismann we are reminded that no disease is inherited, but only the tendency to diseases; this is only a particular statement of a more universal law, that our characters are the particular modes of reaction the body has taken with reference to particular circumstances, and thus the particular form of our features only partially represents our hereditary or idioplasmic characteristics. Epilepsy is not a good disease to experiment with, because it may be caused by a certain weakness of nervous organization due to general malnutrition of the embryo caused by epilepsy (or the nervous disturbance of which epilepsy was the symptom) in the mother. The experiment should be repeated, on the males only, to be valid. Weismann does not hesitate to declare that